classified mammals when kept by the author as household pets will be both new and interesting to English readers.

THE additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. Fred Peake, F.Z.S.; a Great Eagle Owl (*Bubo maximus*) from Nyland, South Finland, presented by Mr. Lindsay von Julin; two Ocellated Turkeys (*Meleagris ocellata*) from Yucatan, Mexico, presented by Mr. W. E. Sibeth; a Crimson-crowned Weaver Bird (*Euplectes flammiceps*), two Red-backed Pelicans (*Pelecanus rufescens*) from West Africa, two Common Blue Birds (*Sialia wilsonii*) from North America, two Great Eagle Owls (*Bubo maximus*) from India, five Four-rayed Snakes (*Elaphis quater-radiatus*), a Black-spotted Snake (*Elaphis dione*), a Lacertine Snake (*Cælopeltis lacertina*), four Dahl's Snakes (*Zamenis dahli*), thirteen Vivacious Snakes (*Tachymenis vivax*), a Four-lined Snake (*Coluber quadrilineatus—var. leopardinus*), South European, deposited; five Australian Wild Ducks (*Anas superciliosa*), three Garganey Teal (*Querquedula circia*), three Common Teal (*Querquedula crecca*), two Horned Tragopans (*Ceriornis satyra*), a Peacock Pheasant (*Polyplectron chinquis*) a Bronze-winged Pigeon (*Phaps chalcoptera*), bred in the Gardens.

## OUR ASTRONOMICAL COLUMN

FAYE'S COMET.—The following ephemeris of this comet is for Berlin midnight, and is calculated from elements accurately perturbed to the approaching perihelion passage, which were communicated by Dr. Axel Möller to the Academy of Sciences at Stockholm in September, 1878:—

| | R.A. h. m. s. | Decl. N. ° ′ | Log. dist. from Earth. |
|---|---|---|---|
| Aug. 1 | 23 16 14 | 10 35·5 | 0·1859 |
| 3 | — 16 16 | 10 40·3 | 0·1784 |
| 5 | — 16 12 | 10 44·3 | 0·1709 |
| 7 | — 16 3 | 10 47·2 | 0·1635 |
| 9 | — 15 48 | 10 49·2 | 0·1562 |
| 11 | — 15 28 | 10 50·2 | 0·1490 |
| 13 | — 15 3 | 10 50·1 | 0·1419 |
| 15 | — 14 33 | 10 48·9 | 0·1349 |
| 17 | — 13 57 | 10 46·6 | 0·1280 |
| 19 | — 13 17 | 10 43·2 | 0·1213 |
| 21 | — 12 31 | 10 38·6 | 0·1147 |
| 23 | — 11 42 | 10 32·8 | 0·1083 |
| 25 | — 10 47 | 10 25·8 | 0·1021 |
| 27 | — 9 49 | 10 17·5 | 0·0961 |
| 29 | — 8 47 | 10 8·0 | 0·0903 |
| 31 | 23 7 41 | 9 57·3 | 0·0847 |

The theoretical intensity of light at the end of the month will be twice as great as at the beginning, when it somewhat exceeds that corresponding to the last observation at Pulkowa in March, 1866. At the return in 1873 the comet was observed on four nights only at Marseilles and at Clinton, New York; the admirable calculations of Dr. Axel Möller gave positions which exhibited hardly appreciable differences from the observations. In the present year it will be nearest to the earth on October 3 (distance = 1·09), and perhaps most favourably circumstanced for observation during the last ten days of the same month, though at no time does the intensity of light exceed its value on October 16, 1858, when the comet was last observed at that appearance with the 10-inch Berlin refractor. The perihelion passage does not take place until January 22, 1881, and although Dr. Axel Möller's ephemeris does not extend beyond the end of the present year, it appears possible that the comet may be observed till quite the end of next February, when its place will still be commanded on a dark sky-ground, or perhaps later; indeed, on April 26, when the comet sets three hours after the sun, its intensity of light is equal to that at the last observation at Pulkowa in 1844.

THE OBSERVATORY, CHICAGO.—The "Annual Report of the Board of Directors of the Chicago Astronomical Society, together with the Report of the Director of the Dearborn Observatory," dated May 13, 1880, is before us. During the preceding year the Observatory had been in charge of Prof. G. W. Hough, formerly of the Dudley Observatory, Albany, Prof. Colbert and Mr. S. W. Burnham taking part in the regular work with the 18½-inch Alvan-Clark refractor. Mr. Burnham's attention, as in previous years, was chiefly directed to the measurement of double stars, including the more interesting binary systems and objects beyond the scope of smaller instruments. A series of observations of the planet Jupiter was commenced on August 27, 1879, and continued on every fine night till February 11. With a magnifying power of 638 the disk was measured on eight nights by Prof. Hough, and six by Prof. Colbert, the resulting values for ellipticity being respectively 1-16·23 and 1-16·73, sensibly smaller than Struve's value, though not differing much from other more recent determinations. The measures further showed "the figure of Jupiter's disk to be a true geometrical spheroid." The belt system during the opposition of 1879 is indicated by the following numbers, the equatorial diameter at the planet's mean distance being 38″·70, and the polar diameter 36″·32.

| | | |
|---|---|---|
| No. 1 ... + 15″·10 | | No. 5 ... − 5″·83 |
| ,, 2 ... + 9·78 | | ,, − ... − 6·94 Red spot. |
| ,, 3 ... + 5·98 | | ,, 6 ... − 9·83 |
| ,, 4 ... + 2·59 | N. edge of equat. belt. | ,, 7 ... − 13·84 |
| ,, − ... − 3·18 | S. edge of equat. belt. | |

An examination of which shows that the belts were symmetrically arranged on either side of the equator, the large red spot coinciding nearly with belt (5). Prof. Hough remarks that the faint belts are not seen with small instruments, in which there is merely a darkening towards the poles. The middle of the great equatorial belt was subject to gradual change in its appearance between September 1 and November 1. At first it was made up essentially of three separate belts, approximately of equal width; gradually it formed in two nearly equal portions with a rift extending through a large part of the planet's circumference. The colour of the equatorial belt was reddish-brown—brick colour.

The red spot was studied from September 3 to February 10. Its colour was similar to that of the equatorial belt, but brighter, and appeared sensibly the same when only partially on the disk as when on the centre. The mean value of its length at the centre of the disk was 12″·73, and its breadth 3″·56, for Jupiter's mean distance; the length appeared to vary to the extent of two seconds, and the breadth about the same amount, but owing to the irregular outline of the object it was difficult to decide whether actual change took place, or whether the discordances in the measures were due to indifferent vision. By observations extending from September 25 to February 10 the time of sidereal rotation was found by Prof. Colbert to be 9h. 55m. 34·2s. The diameters of the satellites were measured on three nights with the following results for the planet's mean distance:—

I. 1″·114 ... II. 0″·980 ... III. 1″·778 ... IV. 1″·457

Prof. Hough states that the two interior satellites of Uranus reported by the Washington observers to be "the most difficult well-known objects in the heavens" can be "readily seen and measured under ordinary atmospheric conditions" with the Chicago refractor: micrometrical observations of *Ariel* were obtained on four nights, *Umbriel* appears to have been measured on one night only, but the weather was unusually adverse to this class of observations.

## PHYSICAL NOTES

A SINGULAR phenomenon was seen (according to the *New York World*) recently off the coast of Florida by the officers of the brigantine *Fortunate*. Shortly after dark two columns of fire appeared, seemingly a mile away. They were fifty yards apart and about 500 feet high, arching towards one another at the top, but without meeting. They were of a dull red colour, without sparks; but the arching portions emitted tremulous rays or streamers of light like those of the aurora. They were visible all night, but faded at daybreak. The weather was fine, not a cloud being seen all night. The following day there was a gale of wind accompanied by thunder, but no rain. It is not stated in what quarter of the heavens the appearance was seen. Could it have been an *aurora?*

M. MARCEL DEPREZ, the ingenious inventor of many pieces of electrical apparatus, has just brought out a new electric motor, in which a piston of soft iron is attracted up and down in a hollow cylindrical electro-magnetic coil with a motion like that of an

ordinary steam-engine piston. This principle is not new, having been employed by Page, Bourbouze, and Du Moncel in the construction of electro-motors. The novel point however about the motor of M. Deprez is that the magnetism of the soft iron core is never either reversed or interrupted. This was the weak point of the earlier machines, but it has been obviated in the new form by the device of dividing the solenoidal coil into sections like the separate coils of the ring-armature of the Gramme machine, the current being thus transmitted first to one part of the cylindrical coil and then to another. The commutator which distributes the current successively to the various sections is worked by an excentric on the shaft of the fly-wheel in the ordinary way, but the "lead" does not require to be so much as a quarter of a revolution.

THE phenomena of explosion of bombs by freezing of water (once studied by Major Williams at Quebec) have been further elucidated by Prof. Hagenbach of Bâle (*Archives des Sciences*, June 15), who exposed, last winter, two iron bombs 15 ctm. exterior diameter and 2·2 ctm. thickness, filled with water and closed by screw stoppers, at temperatures descending to −20°. One bomb, placed out early in the afternoon, burst next morning about 7; the other, exposed about 10 a.m., exploded about 9 p.m. In the latter case the stopper was violently projected to a distance and could nowhere be found (the spotless snow around would have soon revealed its position, if anywhere near). Some parts of the screw thread were detached; there were several fissures round the orifice, and a cylinder of striated ice was forced out, having an irregular top and a curious upward curved filament of ice attached, narrowing from 9 mm. to 3 mm. diameter, and flattened on its upper concave surface. It is thought a little water in suspension got out by the first opening in the screw, flowed down the bomb, and froze; its freezing provoked crystallisation of the whole mass, and the stopper was expelled, the ice following and lifting the attached frozen vein. A little later some water within the expelled cylinder probably froze and burst the top of this cylinder into four pieces, which twisted like petals, causing the filament to turn upwards. The other case was perhaps even more curious. The stopper was not thrown out, but the bomb burst, a triangular piece next the stopper being raised. A round filament curving downwards was here found attached to the protruded ice, and it had some sixteen enlargements or nodes, equidistant 7 mm. The initial jet of water had probably come out with high velocity and straight course, and been solidified, afterwards curving down by the action of gravity. The nodes were doubtless due to the vibratory motion observed in liquid veins.

IN a recent paper to the Vienna Academy (June 10), Prof. Reitlinger and Dr. Wächter throw some new light on the nature of "electrical ring-figures." They consider these to arise from two causes not clearly perceived before; first, a disruption of the metal, with projection of solid, fused, and vaporised particles from it by positive electric potential alone; and second, an electro-chemical decomposition of aqueous vapour present in the atmosphere in which the figures are produced, between point and plate. To the first-named cause is due the *disruption disk* (*Aufreissungscheibe*) in the centre of positive or mixed figures, and appearing oxidised in air, but metal-bright in hydrogen (it affords a new mode of distinguishing positive electricity from negative). With a strong spark (from a Ruhmkorff strengthened with a Leyden jar) the authors got *dispersion and condensation rings* round the disk, presenting various metallic colourings in dry hydrogen. To the second cause (electro-chemical decomposition of water-vapour) are attributed the various-coloured *oxide rings*, giving the ring-figures observed by Priestley, Nobili, Grove, Riess, &c., and Peterin's *bright disks*. The former occur where positive, the latter where negative, electricity passes from the plate into the air. Thus all the ring-figures observed consist of four "form-elements," viz. (1) central disruption-disks; (2) oxide rings; (3) bright disks; and (4) dispersion and condensation rings. It is further found that all these kinds can be altered in form by a magnet.

ACCORDING to the dynamical theory of gases it is probable that the exponent characterising the relation of the coefficient of diffusion to the absolute temperature is higher by unity than in the case of coefficients of internal friction. This has been fully confirmed by experiments of Herr v. Obermayer (*Wien. Akad. Anz.*, May 7), which give, for permanent gases, approximately $1\frac{3}{4}$, for coercible 2 (the lower exponents being $\frac{3}{4}$ and 1). The experiments extended over too few gas-mixtures to determine how the exponent is affected when a coercible and a permanent gas diffuse into each other.

DON EDUARDO LOZANO of Teruel, Spain, has lately published a modest little volume of ninety pages, entitled "Estudios Fisicos," in which some of the more recent advances in physical science are explained in an easy and popular form. Amongst the topics are the blue of the sky, the mechanical equivalent of heat, atmospheric electricity, &c. It is interesting to observe such signs of a revival of interest in the physical sciences in Spain. It is somewhat of a novelty to find the names of Mayer, Hirn, Wells, Dove, and Tyndall in a Spanish treatise; and we draw a good augury from this sign that these names have already penetrated into a country where science has unfortunately been so long at a low ebb.

A BUNSEN burner of modified form has been contrived by M. Terquem which promises to be well adapted for spectrum work and for producing monochromatic light. Instead of the usual two lateral apertures to admit air, the air is allowed to penetrate between the foot of the lamp and the base of the vertical tube, which is for this purpose raised 6 or 7 millims. above the solid foot. The top of the tube is divided into four by a couple of vertical partitions, so that instead of the usual central cone in the flame there are four cones. It is claimed for this flame that it is more solid, and that the temperatures throughout the different parts of the flame are more nearly equal than in the usual Bunsen burner. To procure monochromatic light it suffices to place a small fused bead of sodic chloride between the four central cones of flame.

FOLLOWING out his recent discovery that the prolonged action of the actinic rays upon a sensitised photographic plate produces a reversal of effects, M. Janssen has obtained some interesting results. He has by direct exposure taken a positive photograph of the sun 10 centims. in diameter, showing the spots in their usual dusky tints. He has, after exposures varying from one hour to three hours, obtained perfect positives of landscapes. A view of the park of Meudon thus photographed shows the sun as a white round spot upon a dark sky. Moreover, from such positives other positives can be printed by prolonged exposure; and it is now possible to obtain negative prints of negatives by the same simple expedient. M. Janssen promises at an early date a complete and searching memoir on the whole subject of photography in relation to the different rays of the spectrum.

AN electrical stone-breaker is the latest American invention. A dynamo-electric machine furnishes the power to an electro-magnetic chopper capable of delivering from 1,000 to 2,000 blows per minute. Stone-breaking requires the exertion of very great forces through very small distances, in fact precisely the kind of work for which electro-magnetic machines on a large scale might be expected to be successful, if only the cost of generating the electricity were not so serious.

IN a recent valuable paper on the thermal and optical behaviour of gases under the influence of electric discharges (*Wied. Ann.*, No. 6), Herr E. Wiedemann first studies the thermal phenomena in the case of discharges of the influence-machine, and indicates a different behaviour of the positive and the negative electricity. He then describes an experimental attempt at numerical determination of the quantities which produce a change of the band-spectrum of hydrogen into the line-spectrum. He further investigates the nature of the discharge from the negative electrode in greatly rarefied space. Then he discusses the applicability of other electrical sources, inductoria, large galvanic batteries, and Leyden jars, to spectrum-analytical researches, also the continuous and discontinuous discharges in gases. The paper concludes with theoretical considerations as to the phenomena of discharge in gases and the nature of spectra.

THE known abnormal variation of density of mixtures of acetic acid and water suggested to Herr v. Reiss (*Wied. Ann.*, No. 6) a means of ascertaining whether there were any perceptible relation between the densities and specific heats. He finds that, unlike solid bodies, those mixtures show in general, with increase of density, a proportional increase of specific heat.

AN example of anomalous dispersion by a glowing vapour, viz., that of sodium, has been recently observed by Herr Kundt (*Wied. Ann.*, No. 6). He was preparing for a lecture the well-known experiment of reversal of the sodium line, and per-

ceived that when the absorbent sodium-vapour was very dense and the dark line very broad a peculiar bend outwards appeared in the spectrum at the ends, and on opposite sides, of the line. The cone of sodium vapour in the Bunsen flame acts as a prism with upward horizontal refracting edges. If glowing sodium vapour give dispersion, this cone should give, with horizontal rays passing through it, a vertical (though necessarily impure) spectrum; and if the rays have also passed through a glass prism with horizontal refracting angle, a spectrum of the form above described should be got. From the position, the refractive index of the vapour is greatest for those rays which are most deflected downwards. In agreement with the author's researches on solid bodies and liquids, the refractive index increases greatly as you approach the band from the red side, is less on the green side than on the other, and then quickly increases again. If an actual prism of glowing sodium vapour could be produced, one might observe, even with little thickness of vapour, indications of anomalous dispersion in the narrow absorption lines. Herr Kundt's attempts, however, to change the cone-shaped flame, by means of lateral plates of glass or mica, to a prismatic one, led to nothing.

In a recent paper on the theory of inconstant galvanic elements (*Wied. Ann.*, No. 6) Herr Exner contends that the so-called galvanic polarisation in elements has no existence. The distinction between a Daniell and a Smee element is merely quantitative, not qualitative. What does he mean?

## GEOGRAPHICAL NOTES

We understand that a letter was received in London last Saturday from a member of one of the Belgian Expeditions in Central Africa, stating that he had met Mr. Thomson, with the African Exploration Fund's Expedition, on May 18, at a place some ten days' march from Simba's, so that the party had evidently found it necessary to return to the coast by the caravan route to Bagamoyo or Saadani instead of following the original plan of coming out at Kilwa. It is probable that the change of route was necessitated by civil wars among the native tribes. Mr. Thomson has thus had an opportunity, not contemplated at the outset, of passing through a considerable tract of unknown country between the south-east of Lake Tanganyika and Unyanyembe, and it is satisfactory to know that in so doing he has been able to visit Lake Hikwa and settle its proper position, which has been a puzzle to geographers for some time. In a map accompanying the account of Mr. H. B. Cotterill's journey with the late Capt. Elton northwards from the head of Lake Nyassa, this lake is placed with dotted lines in a position which is probably a good deal too much to the south and east of its true locality. The letter above referred to added that Mr. Thomson was in excellent health, and that he claimed to have traversed 2,000 miles of unknown country in the twelve months he had then been on the march. A telegram from H.M.'s Consul-General at Zanzibar, dated July 17, announces the safe return of Mr. Thomson and his party.

Mr. Alfred Rabaud, president of the Marseilles Geographical Society, has just published (Marseilles: Barlatier-Prissat) a *brochure* entitled "L'Abbé Debaise et sa Mission géographique et scientifique dans l'Afrique centrale," which is accompanied by a photograph of the deceased traveller.

Prof. R. J. Veth, president of the Dutch Geographical Society, has just issued in Italian (Turin: Guido Cora), "Notizia de Selajar et Isole Adiacenti," which is illustrated by an original map of Selajar and other islands of the Celebes group, together with a note by Signor Cora.

The *Travailleur*, with the French Government Expedition for the exploration of the Bay of Biscay, left Bayonne on July 17, having on board MM. Milne-Edwards, father and son, Vaillant, of the Natural History Museum; Fischer, assistant naturalist; Marion of Marseilles, Fohn, Perin, and the English naturalists, Dr. Gwyn Jeffreys and the Rev. Mr. Norman. The results of the expedition may be described at the Swansea meeting of the British Association.

## NEW SCHEME FOR DIRECTING BALLOONS

M. Gabriel Yon, one of the directors of the great Giffard captive balloon, and Mr. E. A. Pearse of Bristol, have each published a pamphlet on the direction of aërostats. The balloon of each inventor is to be elongated according to the principles of the experiments tried by Giffard in 1852 and by Dupuy de Lome in 1871. The propeller is to be moved by a gas-engine in the Pearse balloon, and by a steam-engine in the Yon balloon. M. Yon proposes to use the gas of the balloon as fuel, but only in proportion to loss of weight produced either by uncondensed steam or by consumption of petroleum.

Nothing can be said to be really impracticable in the Pearse scheme, although Mr. Pearse lacks the aëronautical training which distinguishes M. Yon, an aëronaut who ascended with M. Giffard in 1854, and has witnessed all his experiments. The only essential difference between M. Giffard's scheme and the new system is the place given to the fan, which M. Giffard attaches to the car. Practice will only decide whether the alteration projected is an improvement or otherwise. The reason alleged for the change is the bringing of the fan nearer to the centre of resistance. But it obliges the aëronaut to give to his fans a very small diameter, which requires an immense number of rotations in a second, and consequently represents a loss of power.

The calculations appear to have been made with care by M. Yon and Mr. Pearse. A trial would be greatly desirable, although it is impossible to suppose that the aërial carriage of Mr. Pearse or the directing balloon of M. Yon can possibly bring aëronauts to the North Pole for their inaugural trip, they may be instrumental in eliciting useful facts. We may add to the peculiarities of M. Yon's scheme that he uses a small globe inclosed in the lower part of the aërostat called a compensation sphere, and connected by a pipe with a ventilator, for keeping intact the form of his aërial machine. Mr. Pearse does not appear to be convinced of the urgent necessity of abstaining in any aërial construction from every complication which can be avoided at any cost, and he suggests the adoption of some accessory organs which, although designed to help aëronauts, would tax too much the lifting power or the attention of the aërial sailor. Mr. Pearse supposes that he will be able to navigate the air with an excess of weight, and does not pay attention to the intensity of motive power required to counteract gravitation even in a partial manner. He should certainly take advantage of the pamphlet written by his French competitor, who deals mostly with facts belonging to the public, and on which nobody can, in the present state of science, raise any claim as being his own property.

Both these pamphlets are greatly in advance of similar productions, and are creditable to their writers. Mr. Pearse's pamphlet has been only published for private publication. M. Yon's is printed with a number of plates representing many details; but a directing balloon is so complex a matter that this part of the publication can hardly be said to be complete.

Having been the builder of M. Dupuy de Lome's balloon and one of his crew, M. Yon may be said to have witnessed all the great aëronautical constructions of the age. Next to M. Henry Giffard, of whom he claims to be the pupil, he is the most completely qualified aëronaut to work out the solution of the great problem to which a recent success in photography has given unexpectedly in some respects a practical result.

W. De Fonvielle

## EXPERIMENTS WITH THE WIRE TELEPHONE, CHIEFLY ON STRONGLY MAGNETIC METALS

By a wire telephone is meant an instrument like that described in Nature, vol. xxii. p. 168. In most of the experiments mentioned below, the mercury cups there figured were dispensed with, as they are unnecessary when stout wires are used. A small ear-piece with a ferrotype plate was also used instead of the drum-head, whose special purpose was to reproduce music so as to be audible at a distance. For hearing close at hand the ferrotype plate is much superior; indeed with the drum many of the sounds alluded to below could not be heard.

So far as I can see yet, the most probable cause of the sound in the wire telephone, when fine wires of ordinary weakly magnetic metals are used, seems to be variation of the longitudinal tension arising from the variation of the heating effect of the current. It is of course quite possible that there may be a lengthening of the wire due to the passage of the current over and above that arising from the heat developed, although such an effect can scarcely be said to be certainly established by experiment as yet.